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STATE OF ALASKA
Keith H. Miller, Governor



ANNUAL REPORT OF PROGRESS, 1968 - 1969
FEDERAL AID IN FISH RESTORATION PROJECT F-9-1
SPORT FISH INVESTIGATIONS OF ALASKA

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INTRODUCTION

This report of progress involves the findings and work accomplished under the State of Alaska, Federal Aid in Fish Restoration, Project F-9-1, "Sport Fish Investigations of Alaska".

The work conducted during this reporting period constitutes effort on nine separate studies which are crucial in evaluating the sport fishing resources of the State. Recreational demands have necessitated broadening our knowledge of the fishery. All 20 jobs were of continuing nature enabling the Department to keep abreast of present and future impacts on certain fish species. Specifically, the work included work on inventory and cataloging of the sport fish and sport fish waters of the State, sport fishery creel census and access. Special emphasis was given to Dolly Varden, silver salmon, anadromous fish, grayling, salmon, sheefish, pike, and char. The information gathered has provided supporting documentation for better fish management and a basis for necessary future investigations.

The subject matter contained in these reports may be inconclusive. The findings and interpretation are subject to re-evaluation as the work progresses.

RESEARCH PROJECT SEGMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.
Project No: F-9-1 Title: Inventory and Cataloging of the Sport Fish and Sport Fish Waters of the Bristol Bay and Lower Kuskokwim Drainages.
Job No: 12-A

Period Covered: July 1, 1968 to June 30, 1969.

ABSTRACT

The return of king salmon, Oncorhynchus tshawytscha (Walbaum), to the Naknek River was the largest since observations by this agency commenced in 1963.

The fishery on rainbow trout, Salmo gairdneri (Richardson), was monitored in the Naknek River prior to the April 15 closure. Two trout tagged at the outlet of Naknek were later captured in the Brooks River and Bay of Islands fishery. Helicopter surveys of spawning grounds confirmed previously described limits of utilized spawning gravels.

Information is presented on the timing of the spawning migration of silver salmon, O. kisutch (Walbaum), in King Salmon Creek, tributary of the Naknek River.

An estimate of 7,000 to 10,000 fish in the Alagnak (Branch) River king salmon escapement was reported by the Division of Commercial Fisheries. Angling success for rainbow trout in the Kulik River continued on a satisfactory level.

Observations were made on the rainbow trout fishery in the Kvichak River during mid-August and 43 trout were tagged. Investigational effort was concentrated on Lower Talarik Creek where a strong sample was secured and 460 trout were tagged. Sampling results and tag recoveries are now contributing to a definition of seasonal movement through the area, but more intense study is indicated.

Continued sampling of grayling, Thymallus arcticus (Pallas), in the Ugashik watershed produced parameters for size and age of those fish available to the sport fishery. Changes in catch composition to include a greater percentage of smaller-sized fish are thought to be related to the aberrant low-water conditions which prevailed during the reporting period. Returns from current tagging show interchange of grayling between the outlet of lower Ugashik Lake and the connecting river between the system's two major lakes.

The exploration and trial planting of a barren glacial lake in the Cape Newenham area is reported.

RECOMMENDATIONS

1. In the Naknek River Watershed:

- a. Attempt to refine king salmon escapement enumeration techniques by operating a weir on King Salmon Creek as soon as funds become available.
- b. Continue attempts to obtain an index of spawning rainbow trout in the Naknek River and intensify tagging efforts on the mature population; provide added protection for the spawning population by extending the beginning dates of the spring closure.
- c. Obtain an estimate of silver salmon escapement by a float survey of King Salmon Creek during the last 10 days of September.

2. In the Alagnak (Branch) River Watershed:

- a. Continue to monitor the Kulik River rainbow trout fishery.
- b. Investigate the rainbow trout fisheries at the outlet of Kukaklek and Nonvianuk Lakes, Battle River and Moraine Creek.
- c. Survey the king salmon escapement in the Alagnak River.

3. In the Kvichak Watershed:

- a. Extend observation and sampling of rainbow trout to include additional waters, particularly tributaries in the eastern half of Lake Iliamna.
- b. Intensify observations at Lower Talarik Creek and extend them over the year, including winter and spring. Establish a weir on this stream as soon as funds permit in order to define the seasonal movement of the spawning population. Utilize SCUBA equipment to obtain an estimate of numbers of large trout available to the fishery during the peak of fall fishing effort. Obtain fish for tagging by use of electro-fishing methods.
- c. Using all scale and length data collected to date, review aging techniques and determine parameters for age and size of young trout at the time of migration from stream to lake and for their re-entry to the Lower Talarik Creek fishery as larger fish.

4. In the Ugashik Watershed:

- a. Extend observations and sampling of grayling to include winter and spring. Continue summer and fall sampling and tagging to assist in determining movement. Obtain an instantaneous population estimate at the outlet of Lower Ugashik Lake

by a tag-and-recovery program during July or August. Experiment with utilization of SCUBA gear for observation of tagged-to-untagged ratio and an estimate of total numbers present. Study relative efficiency of fly fishing versus spin fishing to determine if any bias may have been introduced in existing data by inter-changeable use of the two types of gear. Conduct further analysis of the age-growth relationship, including (1) sampling of younger age classes by traps and seines, and (2) re-examination of existing scale material available for the area and the development of objective criteria for aging fish in the older age groups.

- b. Continue incidental observations on Dolly Varden and Arctic char in conjunction with "a" above.
5. In the Nushagak River, Wood River Lakes and Tikchik Lakes systems:
- a. Continue observations in the Tikchik Lakes system.
 - b. Initiate a program of investigation of the present status of the important sport fish species in the Wood River system and survey the availability of less popular species in order to promote the potential of abundant species.
 - c. Investigate the sport fishery potential of the Nushagak River king salmon run and extend the inventory of rainbow trout in the Nushagak-Mulchatna system.
6. In the Egegik River and Togiak Bay Watersheds:
- a. Conduct preliminary, qualitative species sampling during the peak dates of seasonal sport fishing pressure to locate potential fisheries.
7. In Cape Newenham Lake, check on the success of the trial plant before making additional introductions. If further planting is deemed feasible, it should, for logistical convenience, be made from Fire Lake Hatchery fish.

OBJECTIVES

- 1. To determine the status of sport fish stocks within the job area.
- 2. To assess and record the environmental characteristics of the existing and potential recreational fishing waters of the job area.
- 3. To enumerate king salmon spawning stocks in the Naknek River, its tributaries, and in the Alagnak (Branch) River.
- 4. To determine the impact of other anadromous and freshwater fishery uses in relation to existing recreational anadromous and resident fish stocks and to investigate, evaluate and develop plans for the enhancement of other anadromous fish stocks.

5. To investigate multiple water-use projects (both public and private) and to assess their effects upon the watersheds of the area.
6. To determine the need for and implementation of fishery restoration measures, including location of suitable sport fish egg sources.
7. To assist as necessary in the investigation of public access status of the sport fishing waters of the job area and to make recommendations for specific public access sites.
8. To provide recommendations for the management of sport fishing resources in these waters and direct the course of future studies.

TECHNIQUES USED

Species composition and distribution was determined by use of seine, gill nets and hook and line.

King salmon escapement in the Naknek River system was estimated by aerial and float surveys. Rainbow trout spawning distribution in the Naknek River, and silver salmon escapement in King Salmon and Big Creeks were surveyed by helicopter through the cooperation of the Air Force. Aerial surveys of Lower Talarik Creek were made by airplane.

Data was collected by personnel of other divisions of this Department and by interested parties who had been given instruction in proper collecting methods.

Fork length measurements were recorded in the field to the nearest quarter-inch and later transposed to metric equivalents.

Age determinations were made by binocular microscope from the scales. Scales for age determination were selected from the area immediately above the lateral line on a diagonal from the posterior insertion of the dorsal fin for rainbow trout and grayling.

Yellow tube-type anchor tags numbered in the 11,000 series, applied with a Floy (Dennison) FD-67 tagging gun, were used. Tags were applied without use of anesthetic.

Dissolved oxygen determinations were made by titration, following the Alsterberg modification of the Standard Winkler Method, and using Hach Chemical Company individually packaged "pillows" of the powdered reagents.

Fingerlings were transported for planting in six 40-gallon containers lined with plastic bags and containing approximately 25 gallons of water each. Ice and anesthetic were added and oxygen was fed to each container through diffusing stones.

FINDINGS

Naknek River King Salmon Studies

A stratified, randomized creel census program was conducted on the Naknek River during the period of the king salmon sport fishery, commencing during the first week of June and continuing through July 11. The total sport catch is estimated at 2,203 fish, a 22 percent increase over the preceding year. A detailed description of the census program is included in the report for Job No. 12-D.

The total take of king salmon from the Naknek River for subsistence purposes is estimated by the Division of Commercial Fisheries at 488 fish.^{1/} This figure is undoubtedly sub-minimal.

No specific commercial king salmon fishery was monitored during 1968, and all kings taken commercially in Kvichak Bay were taken incidentally by the effort directed primarily toward red salmon. This fishery was confined to the regulatory area known as the Naknek Section through 10 a.m., July 11.^{2/} During this period 4,152 kings were reported, nearly half being accounted for after June 8. After the opening of the Kvichak Section on July 11, the catch of kings continued, with another 2,246 fish being tallied before the cessation of the run.^{3/}

Aerial (helicopter) and SCUBA observations of the Naknek River indicate that few kings entered the area utilized by the sport fishery after the first week in July. The indications from the commercial catch of a strong run of this species in the Kvichak Section after this time lend support to the theory that much of the later commercial take was produced by fish bound for the Kvichak and Alagnak (Branch) Rivers. The total contribution of the Naknek River to the commercial catch may be determined to be less than 4,152 fish, since it is reasonable to believe that the contribution of the Kvichak and Alagnak Rivers to this figure is probably greater than is that of the Naknek to the remaining 2,246 fish taken after the opening of the Kvichak Section.

Escapement estimates for King Salmon Creek and Big Creek were secured under unusually favorable conditions and are the highest ever observed. The spawning areas of the main Naknek River were not surveyed until well past the peak, but an extremely good showing was noted in spite of the late date, with a distribution extending beyond that observed in previous years.

Table 1 summarizes available information on escapements in Big Creek. Table 2 lists catch and escapement estimates for Naknek River kings for 1968. It will be noted, allowing for errors in estimation, that the

^{1/} Unpublished reports of the Division of Commercial Fisheries, Alaska Department of Fish and Game.

^{2/} See Regulations of the Alaska Department of Fish and Game for Commercial Fishing in Alaska, 1968 edition.

^{3/} Ibid.

catch-to-escapement relationship was much improved over that of the previous year (Paddock, 1968). While it was obvious that unusually good visibility, due to low runoff conditions in the watershed, contributed to increased escapement counts, it is believed that the level of return for this species was considerably higher than has been observed previously.

TABLE 1 - King Salmon Escapement Survey Summary, Big Creek, Tributary of Naknek River, 1963 - 1968.

<u>Year</u>	<u>Type of Survey</u>	<u>Count</u>	<u>Adjusted Estimate</u>	<u>Remarks</u>
1963	Aerial	1,345	2,690	Float surveys of Big Creek have been relative to concurrent aerial counts by a factor of 2 or greater; hence, the doubling of the aerial count to obtain an adjusted estimate.
1964	Float	1,130	1,160	Float began shortly below head of spawning. Adjusted by adding 1967 count for area not included this year.
1965	Float	578	867	Survey commenced at point presently estimated to be two-thirds of the distance from mouth to headwaters. Adjusted by addition of one-half survey count.
1966	Float	971	1,223	Survey commenced below start of spawning. Adjusted by addition of 1967 count for area not included this year.
1967	Float	1,129	1,129	Survey commenced at head of spawning.
1968	Float	3,716	3,716	Survey commenced at head of spawning.

TABLE 2 - Catch and Escapement Estimates for Naknek River King Salmon, 1968.

<u>Segment of Run</u>	<u>Number of Fish</u>	<u>Remarks</u>
Catch:		
Commercial	4,152	True figure for Naknek River probably much lower.
Subsistence	488	A sub-minimal estimate.
Sport	<u>2,203</u>	A slightly conservative estimate.
Total catch	6,843	

TABLE 2 (Cont.) - Catch and Escapement Estimates for Naknek River King Salmon, 1968.

<u>Segment of Run</u>	<u>Number of Fish</u>	<u>Remarks</u>
Escapement:		
Big Creek	3,716	A minimum figure.
King Salmon Creek	2,204	A minimum figure.
Naknek River	<u>1,200</u>	A conservative estimate.
Total escapement	7,120	
Estimated total return	13,963	

Irregularity in the magnitude of return is an expected feature of this fishery. As utilization of this run by the sport fishery continues to increase, the need for more precise research and management tools is becoming more pressing. A suitable weir site has been located near the mouth of King Salmon Creek. A simple weir at this location would permit a much earlier estimate of the strength of the annual return to that system and would apparently provide an acceptable index of escapement for the entire watershed.

Naknek River Rainbow Trout

The rainbow trout fishery in the Naknek River was observed throughout the year with special emphasis given to the early fishery preceding the protective closure (April 15 to June 7). Ice conditions permitted fishing from mid-February. Many of the mature trout taken in the Naknek Lake outlet between April 1 and April 15 were ripe. A review of the beginning date for this closure is indicated if further protection is to be accorded all trout which are in spawning readiness.

In conjunction with observations of the Naknek River spawning areas, a small-scale effort to tag trout taken by hook and line was continued intermittently during the period from early March through the end of May. A total of 69 rainbow trout were tagged. Table 3 summarizes the information relative to recovery of tagged fish during 1968. Of particular significance are the recoveries from the Angler's Paradise Camp fisheries in the Brooks River and Bay of Islands, demonstrating that interchange does exist between widely separated points within the watershed.

Knowledge of areas utilized for spawning was furthered by aerial surveys conducted from a helicopter. Known spawning areas defined by Redick (1967) were extended. While it proved impossible to count the spawning rainbow trout aerially with the same ease experienced in enumerating red or king salmon, under favorable conditions of visibility, it was practical to secure an indication of relative abundance which may be of future use.

TABLE 3 - Summary of Naknek River Rainbow Trout Tag Recoveries, 1968.

<u>Tagging Location</u>	<u>Date Tagged</u>	<u>Length of Fish (mm)</u>	<u>Recovery Location</u>	<u>Date Recovered</u>
Below Lower Rapids	4/5	630	Bay of Islands, Naknek Lake	8/11
" " "	4/5	725	1/2 mile upstream from location of tagging	5/14
" " "	3/29	445	Naknek River below King Salmon Creek	6/27
1/2 mile below Lake Camp	3/1	335	Outlet of Naknek Lake	6/?
Mid-Rapids Area	3/21	395	Lake Camp Area	6/14
" " "	3/21	355	Brooks River	8/8
" " "	5/20	265	Lake Camp Area	6/?
" " "	5/26	310	Lake Camp Area	6/8

Naknek River Silver Salmon

The characteristics of the silver salmon return to the Naknek River exhibited no apparent departure from that of the preceding year (Paddock, 1968). Two helicopter surveys of King Salmon Creek were made as a pilot attempt to determine the date of peak spawning. At the first survey on September 6, silvers were present throughout the stream but few were paired and most were schooled in the lower reaches of the stream. By September 19, distribution was even throughout the stream and more fish appeared to be spawning. Even though moderately large groups still remained "schooled", it is thought that this was the peak of spawning activity. On this second survey, 550 fish were enumerated. Because silver salmon are more difficult to count than kings or red salmon, and also because of autumn viewing conditions, this first count must be regarded as an index of comparison for future surveys of a similar nature. A much better estimate would be obtained by a float survey during the last part of September.

Alagnak (Branch) River Studies

The king salmon escapement in the Alagnak River is reported by the Division of Commercial Fisheries as approximately 7,000 to 10,000 fish on the basis of an experienced observer's aerial survey, at which time 6,717 kings were enumerated visually.^{4/}

^{4/} Unpublished reports of the Division of Commercial Fisheries, Alaska Department of Fish and Game.

The rainbow trout population of Kulik River continued to provide a healthy fishery when sampled during the last week of July. Fishing success appeared to be reduced somewhat from previous years' experience (Paddock, 1968), but the small size of the sample (N=35) does not allow an accurate comparison. The 36.2 cm mean length of the sport-caught sample does not display a significant change, however, from the 37.8 cm figure obtained in 1967.

Kvichak Watershed Studies

Kvichak River:

The fishery in the Igiugig-Kaskanak Flats area was observed and sampled during the period August 13 to 23. During this time 43 rainbow trout were tagged. The majority of the fish in the area were of the smaller size groups, with only seven fish, out of a total of 54 trout taken, exceeding 50 cm in length. The larger fish did not begin to move in any numbers into the river from Lake Iliamna until after this date.

Lower Talarik Creek:

Field parties operated in this area for brief periods during the months of June, August, September, and November. Information was collected from 554 rainbow trout taken by angling. Of this number, 460 fish were tagged and released.

The age-length relationship of rainbow trout from the Lake Iliamna watershed has been discussed preliminarily by Andrews (1966), whose sample consisted primarily of fish taken in Lower Talarik Creek. Figures 1 and 2 present age and length frequencies for the 1968 samples. The highly variable growth rate may be inferred from a comparison of these figures and is presently attributed to variability in age of initial migration from stream to lake habitat and also to the degree to which the individual fish subsequently remains in the environment which offers the maximum opportunity for accelerated growth.

A definite seasonal movement of size groups through the area of the sport fishery is clearly indicated by the four samples which are compared in Figure 1. It will be noted that the lower range of the November sample includes virtually none of the size groups present there during June, indicating a seasonal migratory movement through the area of the fishery of those fish constituting the lower length ranges available to sport gear.

Migration as indicated by tag returns has been discussed earlier by Paddock (1965 and 1968). During the current segment, two further recoveries of special significance were obtained from a group of 15 fish tagged at Lower Talarik Creek in mid-November, 1967. Both recoveries were made in the Kvichak River near Igiugig during June and July of 1968. Lengths were in the 48.0 to 50.1 cm range when tagged, at which time the fish were immature. During the winter of 1968-69 a Pederson disc-type tag was found on the shore of the Newhalen River which had been placed on a 32.2 cm rainbow in Lower Talarik Creek during September, 1967.

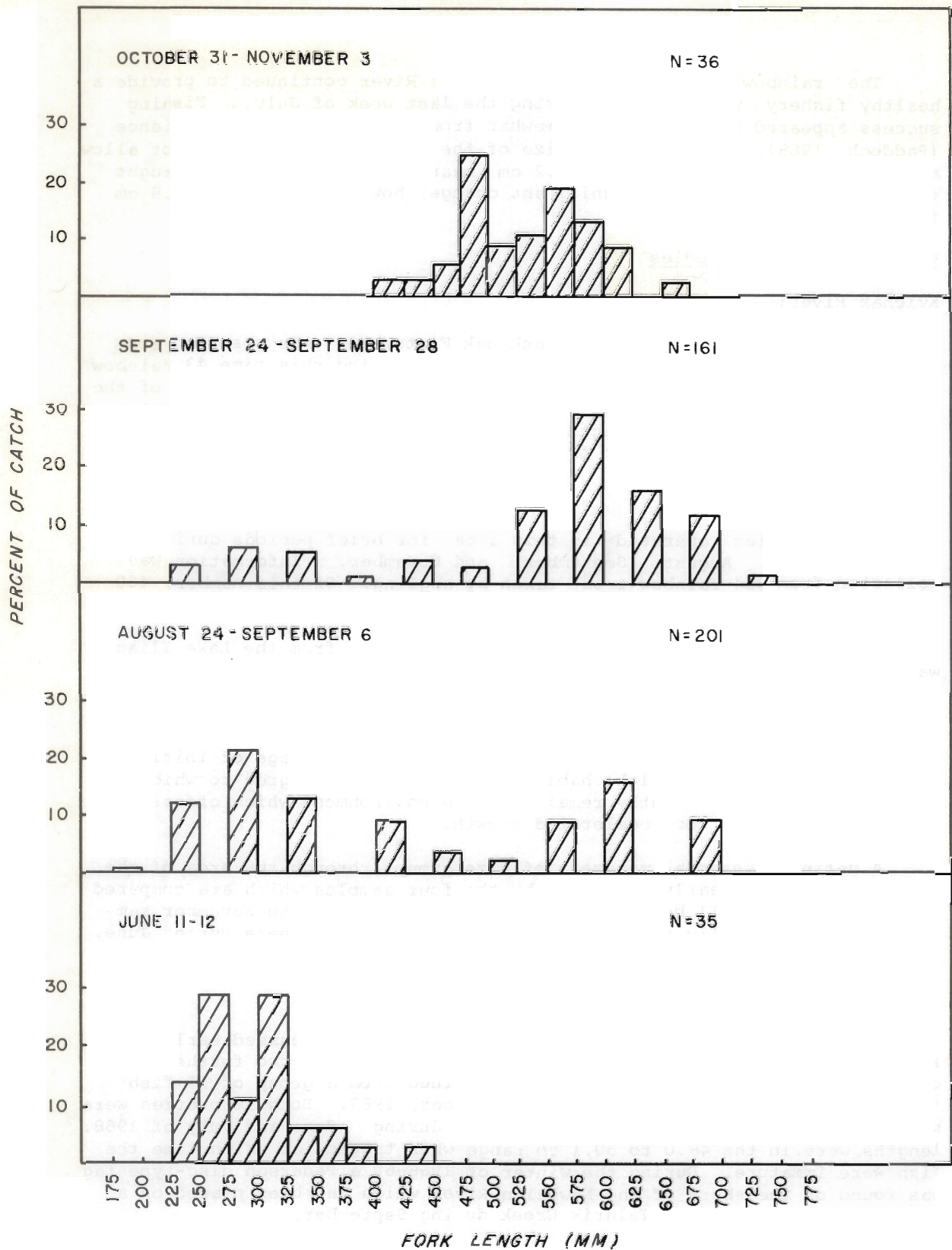


FIGURE 1. LENGTH FREQUENCY DISTRIBUTIONS OF SPORT-CAUGHT RAINBOW TROUT, LOWER TALARIK CREEK, JUNE - NOVEMBER, 1968.

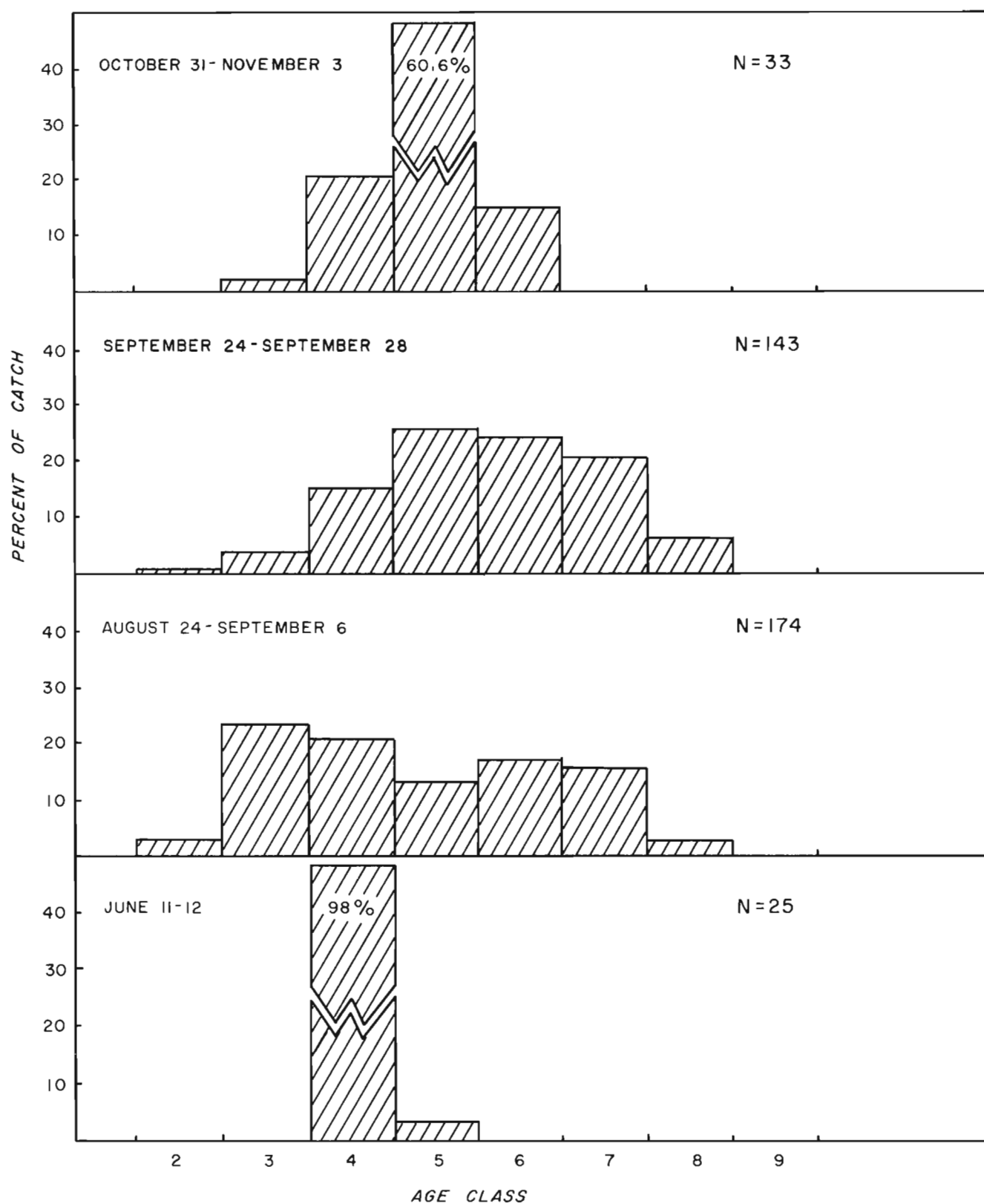


FIGURE 2. AGE-FREQUENCY DISTRIBUTIONS OF SPORT-CAUGHT RAINBOW TROUT, LOWER TALARIK CREEK, JUNE-NOVEMBER, 1968.

Of interest is the recovery in the Iliamna River in August, 1968, of a rainbow trout of approximately 58.5 cm in length. This fish, from the Newhalen River, was tagged on July 31, 1967, by the Fisheries Research Institute.

From a review of recovery data, which includes other returns of Lower Talarik Creek fish from the Newhalen-Iliamna village vicinity, it will be noted that overlapping migratory movement is now well documented over the entire east-west length of Lake Iliamna.

Ugashik Watershed Studies

During the reporting period, work on the grayling of the Ugashik system was confined largely to early August and mid-October. Population information derived from this sampling is presented in Table 4 and Figures 3 and 4, which include similar data from the preceding year's work for comparison. It should be noted that the marked reduction in the observed volume of river flow in the main study areas during 1968 created an ecological situation which contrasted sharply with that observed during 1967, our first year of significant sampling. The change in much of the Narrows and Outlet areas could be described as one from a river to a stream habitat. It is felt that some of the differences between the samples for the two seasons may be ascribed to this cause rather than being representations of actual population shifts of the magnitude reflected in the samples. The possibility that some effects upon these populations due to fishing pressures or other causes should not be ignored.

TABLE 4 - Population Parameters of Ugashik Grayling, 1967 - 1968.

	<u>Sample Size</u>	<u>Mean</u>	<u>Range</u>	<u>Variance</u>	<u>Standard Deviation</u>
I. Analysis of length (mm):					
Ugashik Outlet					
1967	98	448	229		
1968	238	401	375		
Ugashik Narrows					
1967	39	453	184		
1968	87	415	279		
II. Analysis of age:					
Ugashik Outlet					
1967	87	6.14	6	1.477	1.215
1968	238	5.43	10	3.124	1.768
Ugashik Narrows					
1967	36	6.30	5	1.189	1.090
1968	87	5.816	7	3.500	1.871

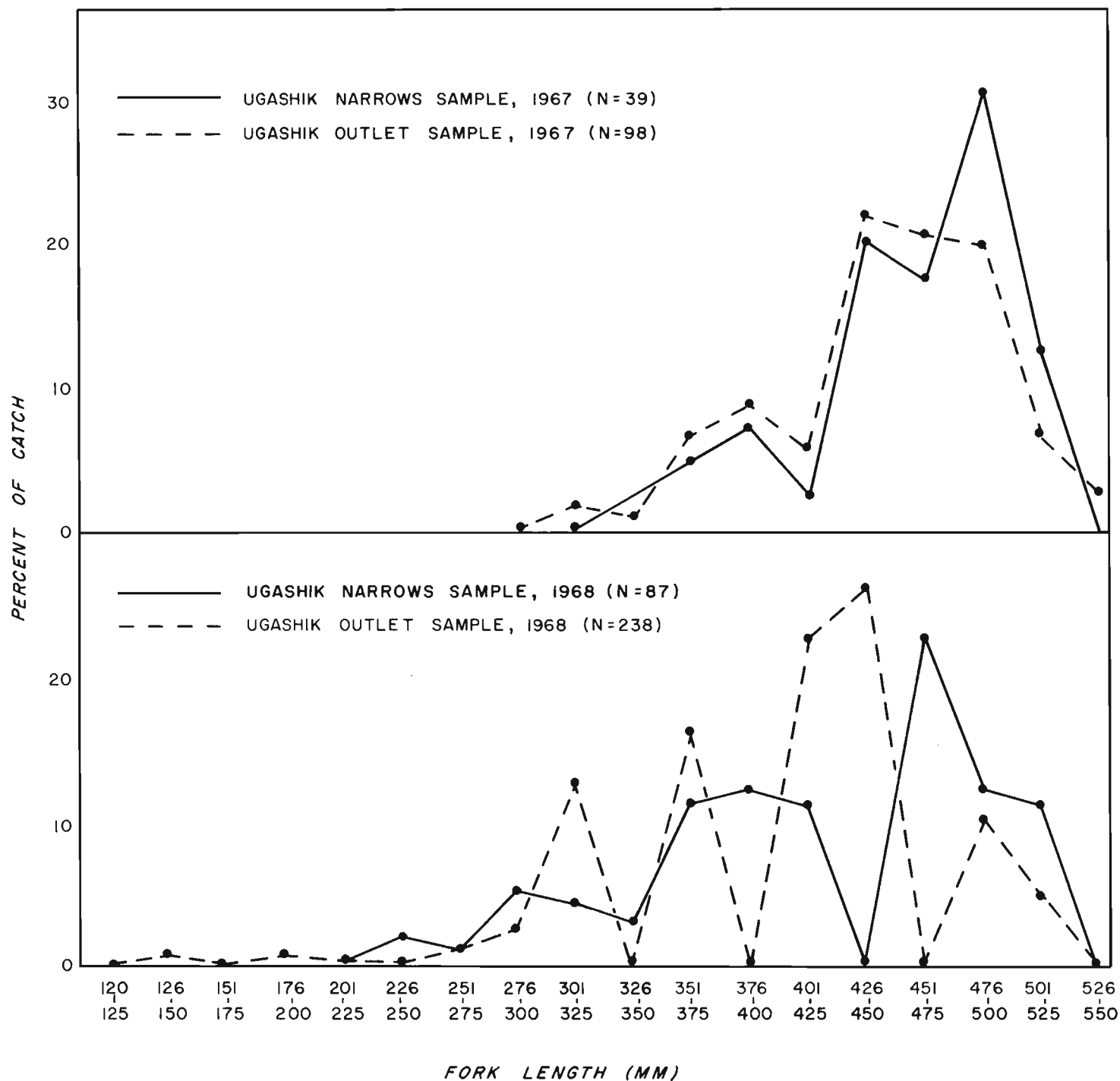


FIGURE 3. LENGTH FREQUENCY OF SPORT-CAUGHT UGASHIK GRAYLING.

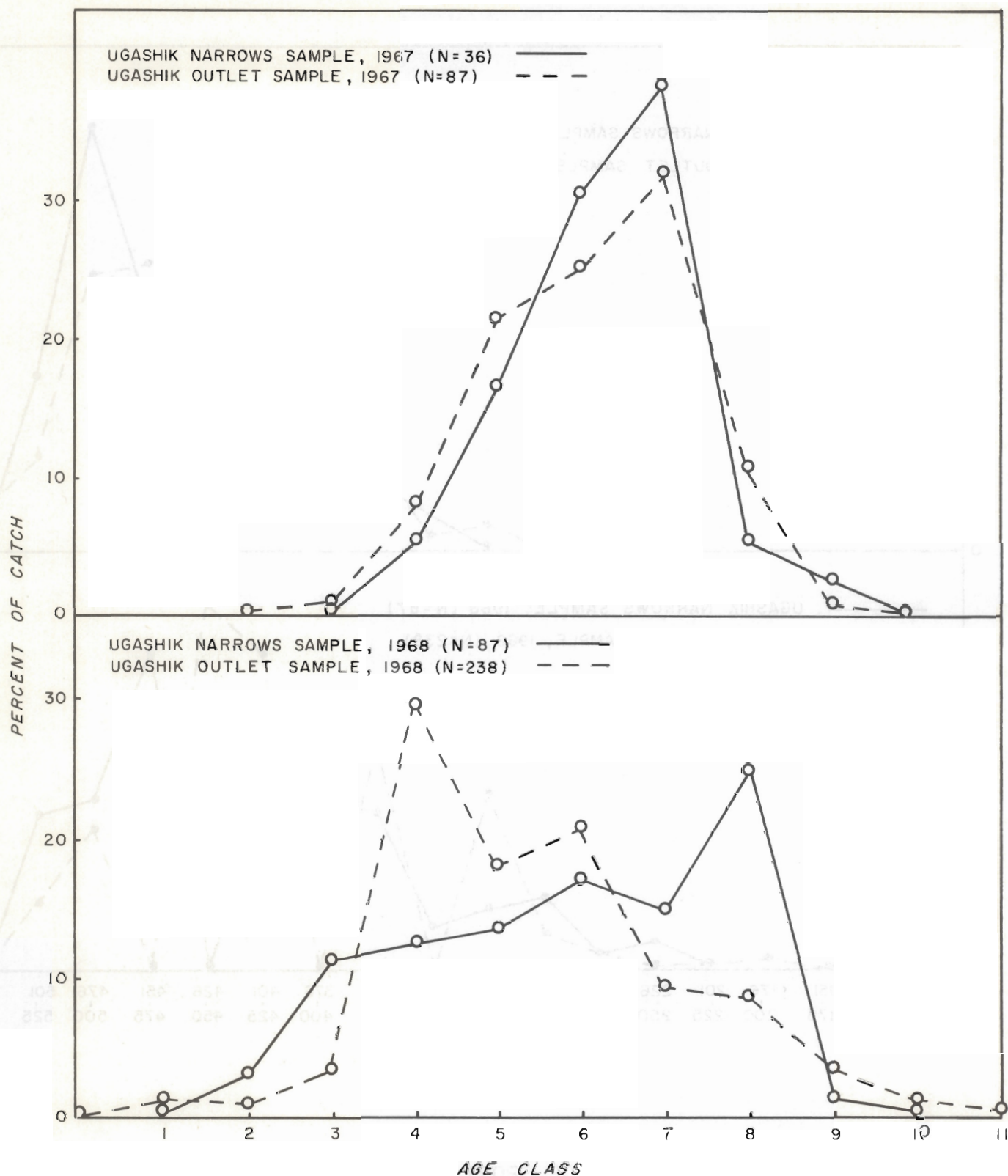


FIGURE 4. AGE FREQUENCY OF SPORT-CAUGHT UGASHIK GRAYLING

As in 1967, sampling was by hook and line for the purpose of securing parameters for that portion of the population available to the sport fishery. Three hundred seventeen fish were tagged, and scales and length measurements obtained from an additional 89 fish.

The most obvious feature of the 1968 work is the presence of the smaller age and size groups, many of which were entirely absent in the 1967 sample. The dissimilarity in age and length composition of Narrows and Outlet fish in 1968 (Figure 4) may be due partly to the effect of a larger October sample from the Outlet area than was obtained in the previous year, but seems to be indicative of greater availability of older age groups in the Narrows fishery during the August sampling. By mid-October, grayling had virtually ceased to be available to hook and line at the Narrows, so no comparable October sample from this site was possible. Figure 5 illustrates the decline in availability of the older age classes at the Outlet, coincidental with the approach of colder weather.

Figure 6 portrays the age-length relationship of a combined sample of 237 fish from the Narrows and the Outlet during the first week of August. Length variation of the same age classes between the two locations was not consistent and is attributed to experimental error rather than to an actual difference, hence the combination seems permissible. The irregularity of the curve in the upper age groupings probably results from difficulty in obtaining a correct age determination for an unknown portion of the total sample of those age groups affected. Improved criteria should be developed for evaluation of scales of age VII and older.

During tagging operations, numerous recoveries were made in the immediate area as tagging continued. Little "learning effect" appears to be exhibited. One fish was recovered twice in the same day. Of the eight recoveries made during the reporting period which took place after a lapse of at least one week, five were obtained within the general area of the original tagging. Three, however, are of special significance in that they demonstrated movement from the Outlet area to the Narrows. This movement took place during August within a period of from two to three weeks. The full significance of such migration may not become apparent until a better understanding is obtained of other seasonal movements, but the implications of these returns for management purposes are immediate.

Planting of Barren Lakes

During the month of April, a visit was made to the Air Force site at Cape Newenham for the purpose of checking the suitability for introduction of sport species into a small, barren, glacial cirque lake located nearby at an elevation between 800 and 1,000 feet. Oxygen levels at this critical period were found to be high, evidently due to a high influx of spring-fed waters from the surrounding peaks. Food organisms were also found to be plentiful at this time. An effective transplant of approximately 350 juvenile salmon, composed mainly of 40-to-the-pound red salmon smolts, but including a number of age 1 kings and silvers, was completed successfully in July. The fish were captured from wild stock in the Naknek River. During this visit, it was observed that the unusual degree of productivity noted earlier may stem from fertilization derived from large flocks of kittiwakes, Rissa sp., which nest in the surrounding cliffs. Whether these birds will constitute a prohibitive source of predation on any introduced fish population awaits further observation.

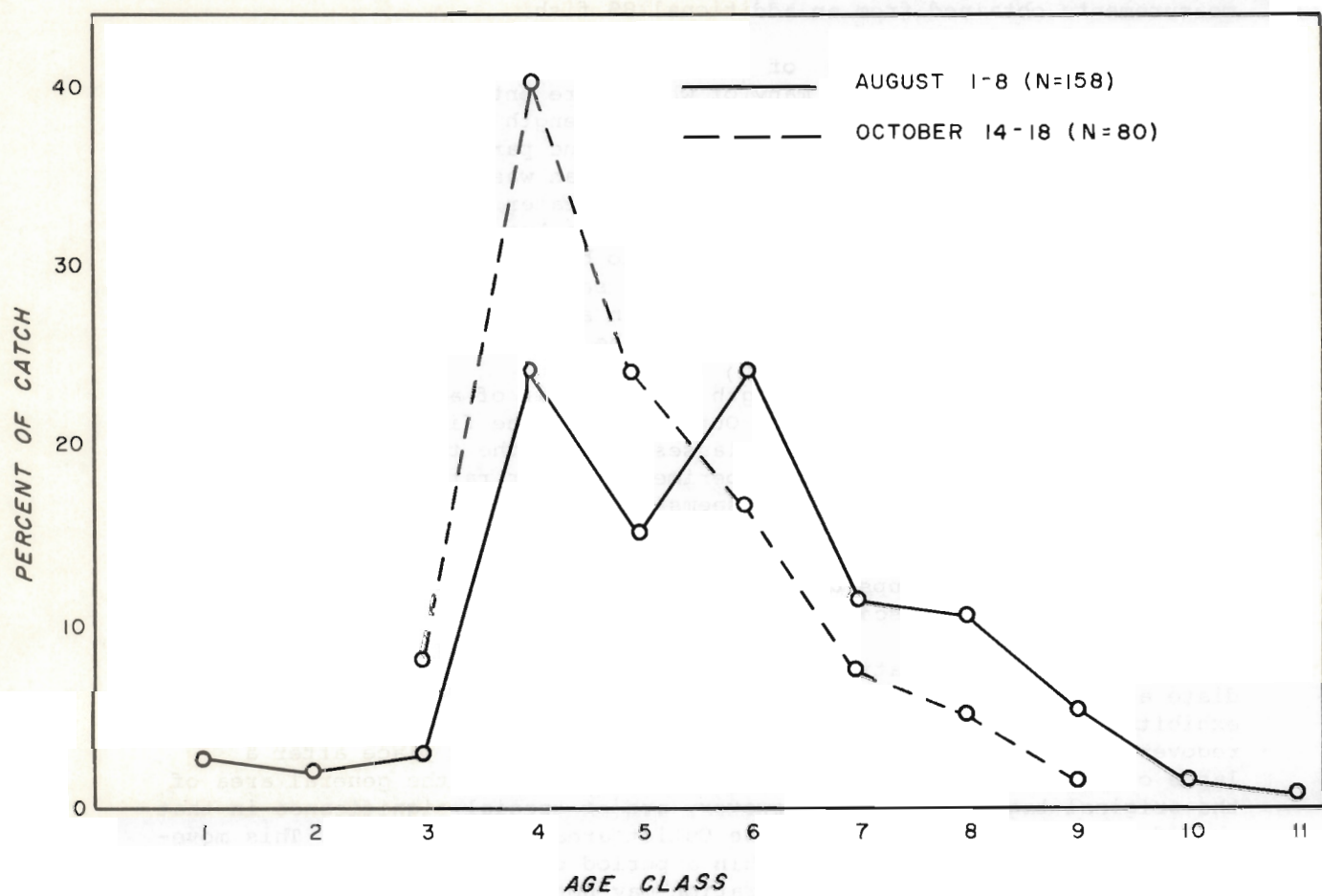


FIGURE 5. AGE FREQUENCY OF SPORT-CAUGHT GRAYLING, UGASHIK OUTLET, 1965.

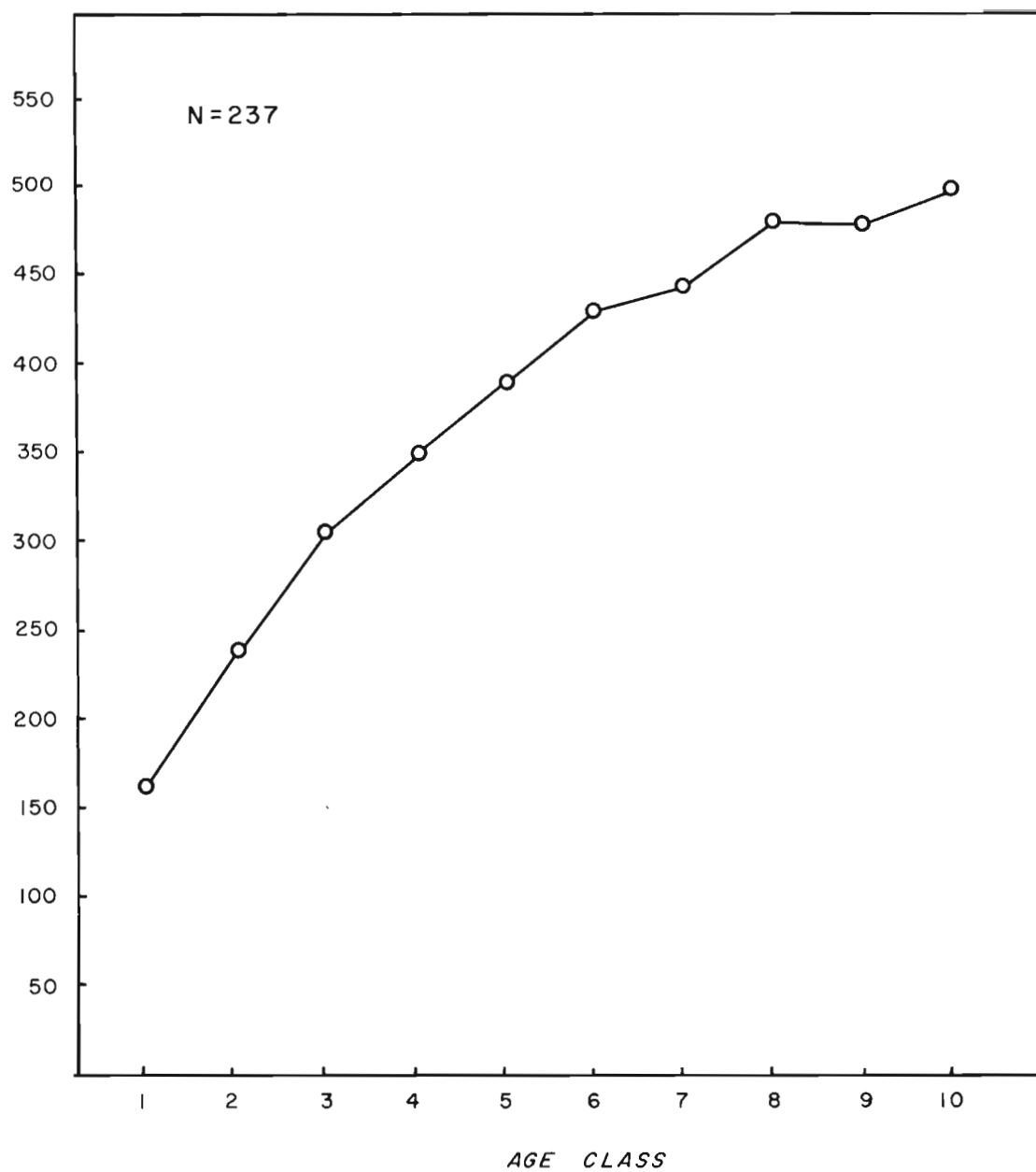


FIGURE 6. LENGTH-AGE RELATIONSHIP, UGASHIK GRAYLING
AUGUST, 1967,

LITERATURE CITED

Andrews, Rupert E. 1966. Inventory and Cataloging of the Sport Fish and Sport Fish Waters in the Bristol Bay and Lower Kuskokwim Drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1965-1966, Project F-5-R-7, 7:171-181.

Paddock, Alfred D. 1965. Investigation of Sport Fish Populations in Selected Western Alaska Lakes. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1964-1965, Project F-5-R-6, 6:249-261.

_____. 1968. Inventory and Cataloging of the Sport Fish and Sport Fish Waters in the Bristol Bay and Lower Kuskokwim Drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1967-1968, Project F-5-R-9, 9:205-222.

Redick, R. Russell. 1967. Inventory and Cataloging of the Sport Fish and Sport Fish Waters in the Bristol Bay and Lower Kuskokwim Drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1966-1967, Project F-5-R-8, 8:189-203.

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Date: April 15, 1969.

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